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(54) TECHNIQUE FOR REDUCING BACKSIDE PARTICLES

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(57) ABSTRACT

A technique for reducing backside particles is disclosed. In one particular exemplary embodiment, the technique may be realized as an apparatus for reducing backside particles. The apparatus may comprise a delivery mechanism configured to supply a cleaning substance to a platen, wherein the platen is housed in a process chamber. The apparatus may also comprise a control unit configured to cause the process chamber to reach a first pressure level, cause the cleaning substance to be supplied to a surface of the platen, and cause the process chamber to reach a second pressure level, thereby removing contaminant particles, together with the cleaning substance, from the surface of the platen.

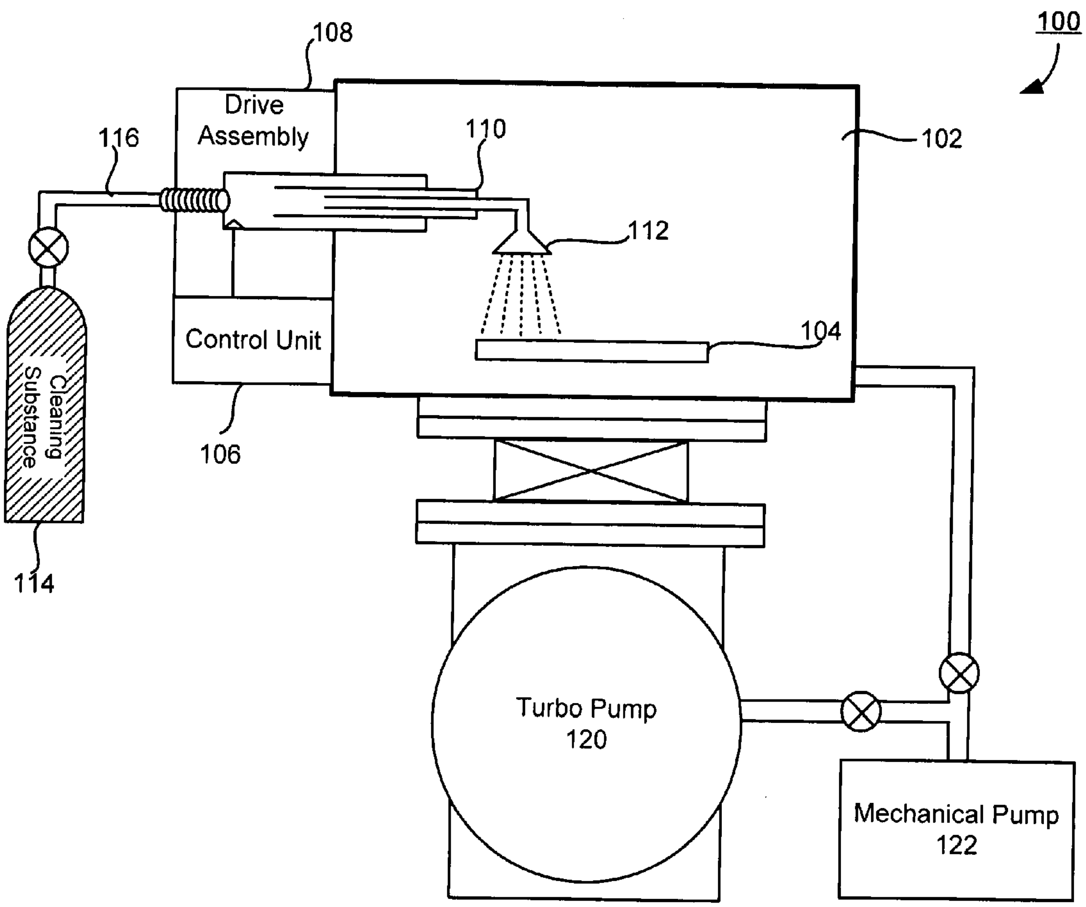


Figure 1

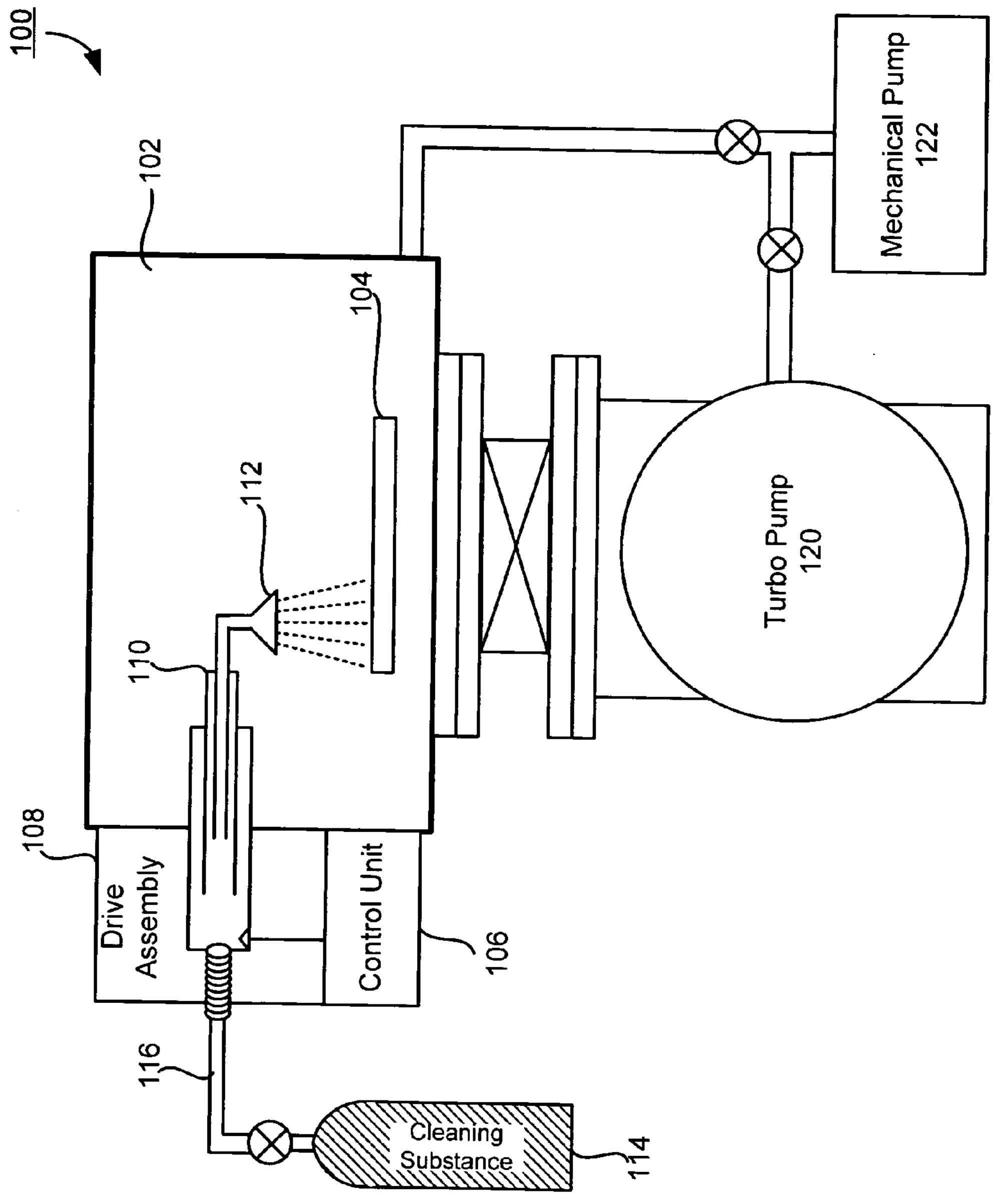

100
102
104
112
110
108
Drive Assembly
Control Unit
106
116
Cleaning Substance
114
Turbo Pump
120
Mechanical Pump
122

Figure 2

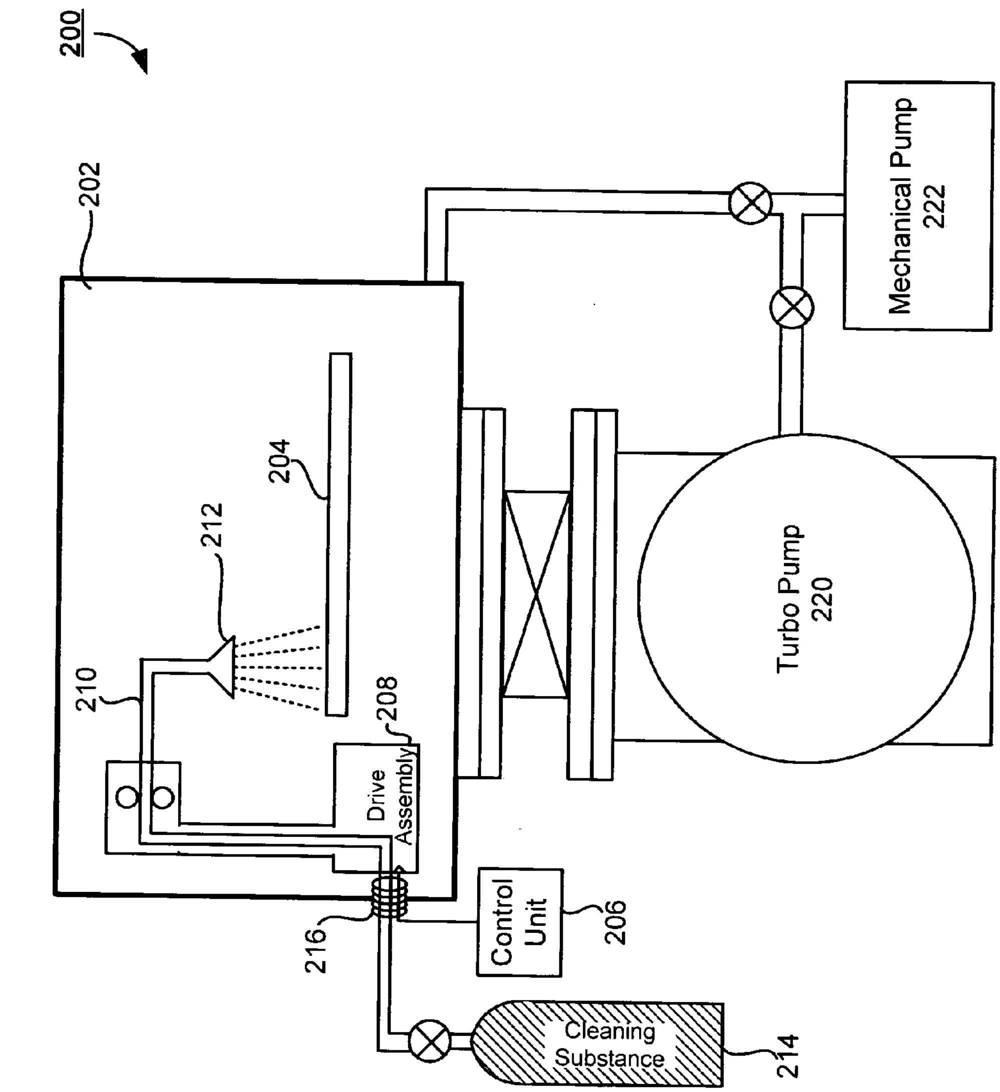

200
202
204
212
210
208
Drive Assembly
216
Control Unit
206
Cleaning Substance
214
Turbo Pump
220
Mechanical Pump
222

Figure 3

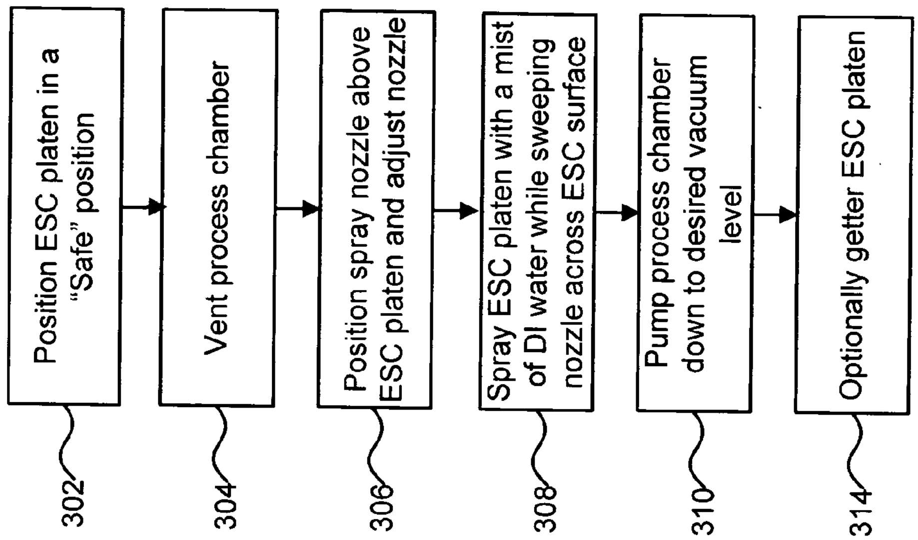
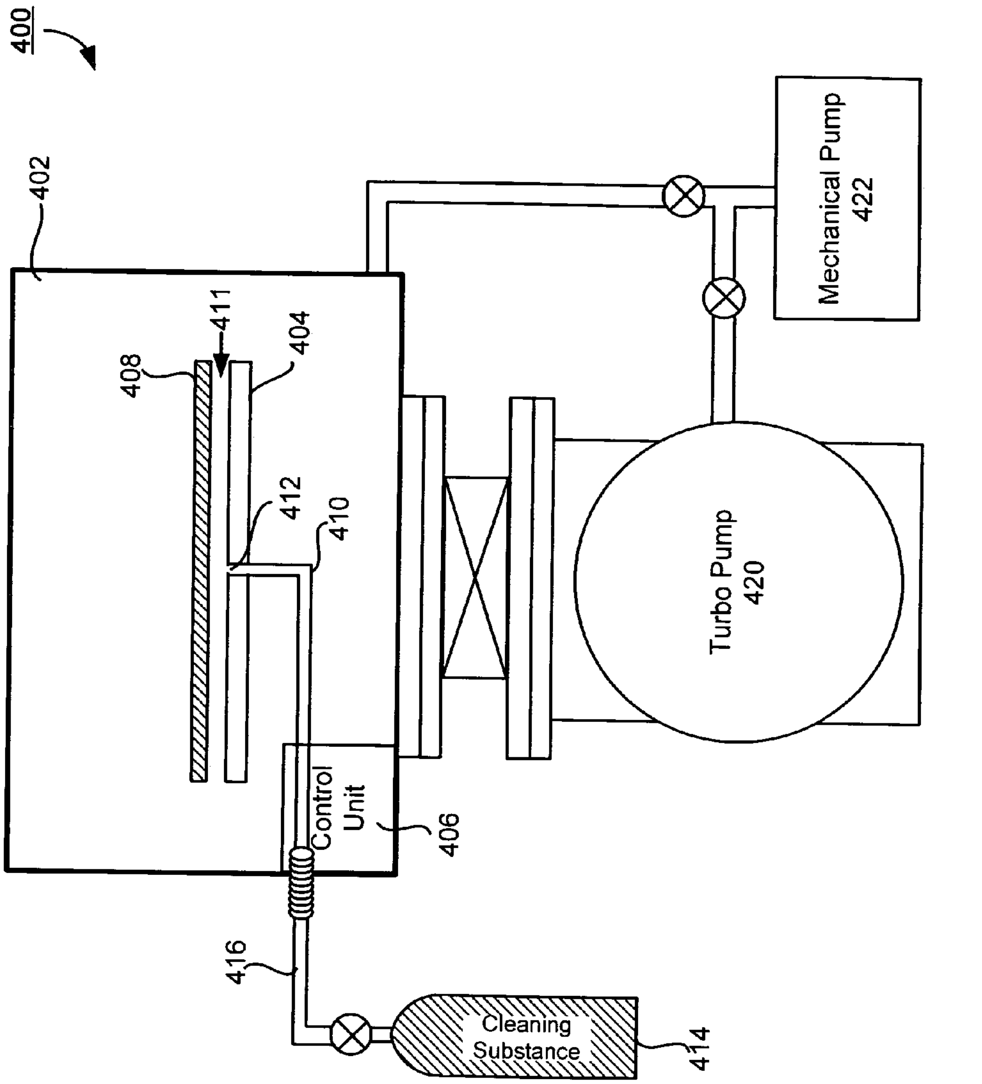

Position ESC platen in a "Safe" position
302
Vent process chamber
304
Position spray nozzle above ESC platen and adjust nozzle
306
Spray ESC platen with a mist of DI water while sweeping nozzle across ESC surface
308
Pump process chamber down to desired vacuum level
310
Optionally getter ESC platen
314

Figure 4


400
402
408
411
404
412
410
Control Unit
406
416
Cleaning Substance
414
Turbo Pump
420
Mechanical Pump
422

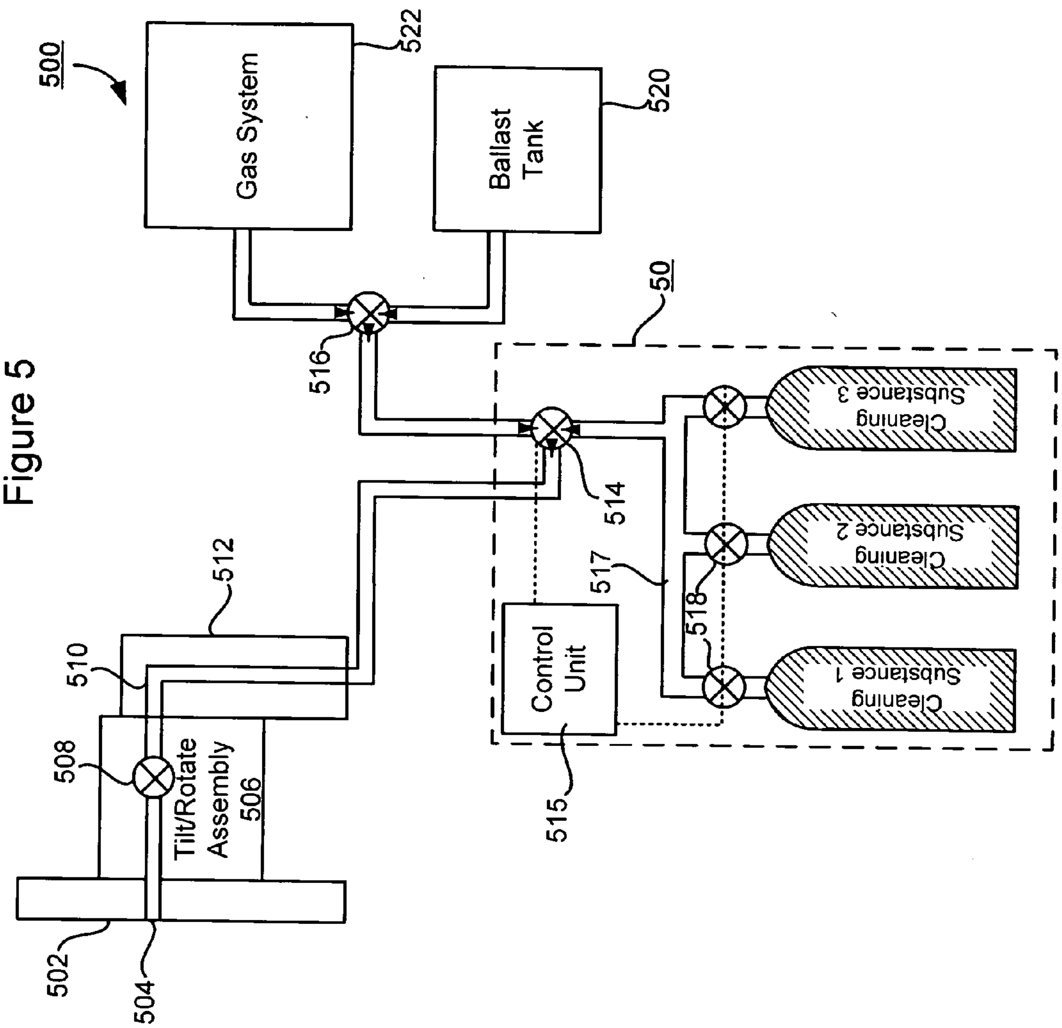

500
Gas System
522
Ballast Tank
520
516
50
514
517
518
Control Unit
515
Cleaning Substance 1
Cleaning Substance 2
Cleaning Substance 3
512
510
508
Tilt/Rotate Assembly 506
502
504

Figure 5

TECHNIQUE FOR REDUCING BACKSIDE PARTICLES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority to U.S. Provisional Patent Application No. 60/635,524, filed Dec. 13, 2004, which is hereby incorporated by reference herein in its entirety.

FIELD OF THE DISCLOSURE

[0002] The present disclosure relates generally to semiconductor manufacturing equipment and, more particularly, to a technique for reducing backside particles.

BACKGROUND OF THE DISCLOSURE

[0003] Manufacturing of microelectronic products, such as microprocessors, integrated circuits (ICs) and other micro-devices, requires a clean environment with a low level of pollutants such as dust, aerosol particles and chemical vapors. Such a clean environment is typically provided by housing semiconductor manufacturing equipment inside clean-rooms and by controlling contamination inside the equipment. As feature sizes of modern microelectronics continue to shrink, what used to be a negligible number of contaminant particles can now adversely affect production yield as well as device performance.

[0004] To minimize contamination, process spaces inside semiconductor manufacturing equipment are often maintained at high or ultra-high vacuum levels. However, even at relatively high vacuum levels, unwanted particles may still be present and can contaminate semiconductor wafers processed therein. For example, in an automated system equipped with an electrostatic clamp (ESC), contaminant particles may originate from the ESC itself due to normal wear. In addition, contaminant particles may be transferred to the ESC from other sources, typically other parts of the automatic wafer handling system such as pick arm pads, orienter pads, pass-through cassettes, and buffer robot end effectors. These contaminant particles may be transferred to the semiconductor wafers, typically on the backside. Hence, these contaminant particles are often referred to as backside particles (BSP's).

[0005] It is well known to clean an ESC platen by manually wiping the platen surface with a pre-wetted semiconductor wipe such as TexWipe™ 609. However, such cleaning method often increases, rather than decreases, the BSP level. In one experiment, a 200 mm ESC was found to have a BSP level of 17,870 particles prior to cleaning. After cleaning the ESC with a TexWipe™ 609 wipe, the BSP level rose to 70,000 particles. The increase in BSP level can be attributed to the interaction between the wipe's surface texture and the microstructure of the ESC platen surface. In similar experiments, other semiconductor wipes, such as TexWipe™ Alpha 10 and MiraWipe™, were evaluated and similar results were found.

[0006] In addition, the method of manually wiping a component often requires that a vacuum chamber be opened for each cleaning and the vacuum has to be re-established afterwards. Such a process is not only time-consuming but can significantly increase cost of operation as well.

[0007] It is also well known to manually clean a process chamber with deionized (DI) water and semiconductor wipes. For example, a process chamber may be manually wiped down using a semiconductor wipe dampened with DI water. Alternatively, DI water may be manually sprayed into the process chamber, followed by a manual wiping step, in order to remove particles. However, even manual spraying of an ESC platen surface with DI water has not been attempted for fear of damaging the ESC surface coating which contacts a semiconductor wafer during electrostatic clamping.

[0008] In view of the foregoing, it would be desirable to provide a solution for removing contaminant particles which overcomes the above-described inadequacies and shortcomings.

SUMMARY OF THE DISCLOSURE

[0009] A technique for reducing backside particles is disclosed. In one particular exemplary embodiment, the technique may be realized as an apparatus for reducing backside particles. The apparatus may comprise a delivery mechanism configured to supply a cleaning substance to a platen, wherein the platen is housed in a process chamber. The apparatus may also comprise a control unit configured to cause the process chamber to reach a first pressure level, cause the cleaning substance to be supplied to a surface of the platen, and cause the process chamber to reach a second pressure level, thereby removing contaminant particles, together with the cleaning substance, from the surface of the platen.

[0010] In accordance with other aspects of this particular exemplary embodiment, the establishment of the second pressure level in the process chamber may cause at least a portion of the cleaning substance to sublimate, thereby removing the contaminant particles from the surface of the platen.

[0011] In accordance with further aspects of this particular exemplary embodiment, the platen may be an electrostatic clamp having a composite surface coating.

[0012] In accordance with additional aspects of this particular exemplary embodiment, the apparatus may comprise a wafer handling mechanism that transfers a clean wafer onto and then from the platen, thereby removing contaminant particles from the surface of the platen.

[0013] In accordance with another aspect of this particular exemplary embodiment, the delivery mechanism may comprise a nozzle and a drive assembly. The drive assembly may be configured to position the nozzle proximate to the surface of the platen. And the control unit may be configured to cause the nozzle to spray the surface of the platen with the cleaning substance. In addition, the nozzle may be an articulated nozzle. The nozzle may be positioned approximately six inches above the surface of the platen. Further, the control unit may be capable of causing the drive assembly to sweep the nozzle across the surface of the platen, thereby applying a substantially uniform coating of the cleaning substance to the surface. Alternatively, the control unit may be capable of causing the drive assembly to move the platen in a sweeping motion relative to the nozzle, thereby applying a substantially uniform coating of the cleaning substance to the surface.

[0014] In accordance with yet another aspect of this particular exemplary embodiment, the delivery mechanism may comprise a flat member that is positioned above the surface of the platen at such a small distance that the space between the flat member and the surface of the platen causes the cleaning substance to be spread across the surface.

[0015] In accordance with still another aspect of this particular exemplary embodiment, the cleaning substance comprises one or more substances selected from a list consisting of: DI water, alcohol, carbon dioxide, ionized dry air, and ionized dry nitrogen.

[0016] In another particular exemplary embodiment, the technique may be realized as a method for reducing backside particles. The method may comprise the step of positioning a platen inside a process chamber. The method may also comprise the step of venting the process chamber to a first pressure level. The method may further comprise the step of supplying a cleaning substance to a surface of the platen. The method may additionally comprise the step of pumping the process chamber to a second pressure level, thereby removing contaminant particles, together with the cleaning substance, from the surface of the platen.

[0017] In accordance with other aspects of this particular exemplary embodiment, the pumping of the process chamber may cause at least a portion of the cleaning substance to sublimate, thereby removing the contaminant particles from the surface of the platen.

[0018] In accordance with further aspects of this particular exemplary embodiment, the platen may be an electrostatic clamp having a composite surface coating.

[0019] In accordance with additional aspects of this particular exemplary embodiment, the method may further comprise the step of spraying the cleaning substance onto the surface of the platen in a sweeping pattern, thereby applying a substantially uniform coating of the cleaning substance on the surface.

[0020] In accordance with another aspect of this particular exemplary embodiment, the cleaning substance may comprise deionized water, and a mist of the deionized water may be sprayed onto the surface of the platen to coat the surface with droplets of the deionized water.

[0021] In accordance with yet another aspect of this particular exemplary embodiment, the cleaning substance may comprise carbon dioxide, and the surface of the platen may be sprayed with a snow of the carbon dioxide, the snow comprising solid carbon dioxide particles.

[0022] In accordance with still another aspect of this particular exemplary embodiment, the cleaning substance may comprise an ionized gas, and the surface of the platen may be sprayed with the ionized gas.

[0023] The present disclosure will now be described in more detail with reference to exemplary embodiments thereof as shown in the accompanying drawings. While the present disclosure is described below with reference to exemplary embodiments, it should be understood that the present disclosure is not limited thereto. Those of ordinary skill in the art having access to the teachings herein will recognize additional implementations, modifications, and embodiments, as well as other fields of use, which are within the scope of the present disclosure as described herein, and with respect to which the present disclosure may be of significant utility.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] In order to facilitate a fuller understanding of the present disclosure, reference is now made to the accompanying drawings, in which like elements are referenced with like numerals. These drawings should not be construed as limiting the present disclosure, but are intended to be exemplary only.

[0025] **FIG. 1** shows a block diagram illustrating an exemplary system for reducing backside particles in accordance with an embodiment of the present disclosure.

[0026] **FIG. 2** shows a block diagram illustrating another exemplary system for reducing backside particles in accordance with an embodiment of the present disclosure.

[0027] **FIG. 3** shows a flow chart illustrating an exemplary method for reducing backside particles from an electrostatic clamp in accordance with an embodiment of the present disclosure.

[0028] **FIG. 4** shows a block diagram illustrating an exemplary system for reducing backside particles in accordance with an embodiment of the present disclosure.

[0029] **FIG. 5** shows a block diagram illustrating another exemplary system for reducing backside particles in accordance with an embodiment of the present disclosure.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0030] To solve the aforementioned problems associated with existing cleaning methods for semiconductor manufacturing equipment, embodiments of the present disclosure introduce an in situ cleaning technique that effectively reduces backside particles transferred to semiconductor wafers. One or more cleaning substances may be supplied to a surface of a platen (or other components) located inside a process chamber. When the process chamber is pumped down, the cleaning substance(s) may be removed from the platen (or component) surface, together with contaminant particles thereon. The following description will focus on the cleaning of a platen. However, it should be appreciated that the exemplary embodiments described herein may be easily adapted to clean other components in semiconductor manufacturing equipment.

[0031] Referring to **FIG. 1**, there is shown a block diagram illustrating an exemplary system **100** for reducing backside particles in accordance with an embodiment of the present disclosure. The system **100** may comprise a process chamber **102** that is coupled to, for example, a turbo pump **120** and a mechanical pump **122**. The vacuum pumps (**120** and **122**), individually or in combination, may cause the process chamber **102** to reach a desired vacuum level. The process chamber **102** may be part of semiconductor manufacturing equipment, and may serve one or more semiconductor processing functions such as, for example, chemical vapor deposition (CVD), physical vapor deposition (PVD), ion implantation, or plasma etching.

[0032] A platen **104** capable of holding one or more wafers may be housed inside the process chamber **102**. The platen **104** may be part of an automatic wafer handling assembly that is capable of transferring wafers to or from an adjacent chamber (not shown). For automatic wafer handling purposes, the platen **104** may comprise an electrostatic clamp which typically may have a composite surface coating, although it should be understood that a non-electrostatic clamp with or without a composite surface coating may be used as well.

[0033] The system **100** may also comprise a control unit **106** which may facilitate control over a number of other components of the system **100**. The system **100** may further comprise a drive assembly **108** which is controlled by the control unit **106** and coupled to a spray arm **110**. At the end of the spray arm **110**, there may be a nozzle **112**. A source **114** of a cleaning substance may be coupled to the spray arm **110** via a pipeline **116**, and the cleaning substance may be delivered through the spray arm **110** to the nozzle **112**, which may be articulated.

[0034] The cleaning substance source **114** may contain one or more cleaning substances typically in either liquid or gaseous states. A preferred cleaning substance should be a gas or fluid that is readily available and easy to store or handle in a clean-room. A preferred cleaning substance can also be delivered in small amounts and its residual vapor can be easily removed from a vacuum chamber. Typical cleaning substances may include but are not limited to: DI water, alcohol, carbon dioxide (e.g., CO_2 snow with solid CO_2 particles), ionized dry air, or ionized dry nitrogen, etc. The ionized dry air or nitrogen may be particularly effective in removing those particles that are held to the platen surface by electrostatic forces. These ionized gases may be produced, for example, from an AirForce™ Ionizing Blow-Off Gun available from Ion Systems, Inc. According to some embodiments, it may be beneficial to use a combination of two or more cleaning substances to achieve a desired result. For example, a mixture of DI water and alcohol may be delivered through the spray arm **110** to the nozzle **112**. Such a combination of two or more cleaning substances may also be referred to as one cleaning substance (i.e., in singular form).

[0035] The spray arm **110** may be a telescopic type as shown in **FIG. 1**, or it may be any other type of assembly that can be driven by the drive assembly **108** and controlled by the control unit **106**. Through movements of the spray arm **110**, the nozzle **112**, which may be articulated, may be positioned in a desired location relative to a surface of the platen **104**. Typically, the nozzle **112** is positioned proximate to and above the platen **104**. According to one embodiment, the nozzle **112** may be approximately six inches above the platen **104**.

[0036] The nozzle **112** may be capable of spraying out a controlled stream or mist of gases, liquids, or solid particles. That is, flow rates of the cleaning substance through the nozzle **112**, as well as spray density, may be controlled, for example, by the control unit **106**. The spray arm **110** and the nozzle **112** may also be adjusted to provide desired angles of incidence on the surface of the platen **104**. When spraying, the nozzle **112** may remain stationary. Alternatively, the spray arm **110** may move the nozzle **112** in predetermined patterns, single- or multi-dimensionally, across the surface of the platen **104**. Through controlled movement of the nozzle **112**, as well as regulated flow rate and spray density, the surface of the platen **104** may be spray-coated with selected cleaning substance(s).

[0037] When it is desirable to clean the platen **104**, the process chamber **102** may be vented to approximately atmospheric pressure (or a pressure level in the rough vacuum regime depending upon the cleaning substance's thermodynamic properties as well as conditions such as vacuum pumping flow rate, pump down time, and temperature, etc.) and the platen **104** may be placed in a safe position. The control unit **106** may, either automatically or while operated by a human operator, cause the nozzle **112** to be positioned above the platen **104** and to spray a selected cleaning substance onto the platen surface. Then, the process chamber **102** may be pumped down to a desired vacuum level (e.g., rough vacuum, or high vacuum at 10^{-7}-10^{-6} Torr). As the cleaning substance sublimates (i.e., leaving the surface of the platen **104** in vapor), contaminant particles on the platen surface may be removed, either out of the process chamber **102** or onto the chamber floor. Next, the platen **104** (and/or the process chamber **102**) may be optionally gettered with a clean wafer having a low particle count. The clean wafer may be briefly transferred to the platen **104** and then returned to a cassette, which process may be repeated to further reduce contaminant particles from the platen surface.

[0038] The drive assembly **108**, spray arm **110**, nozzle **112**, cleaning substance source **114**, and pipeline **116** may be collectively referred to as a "delivery mechanism". There may be great flexibility as to where the delivery mechanism is mounted relative to the process chamber **102**. As shown in **FIG. 1**, a good portion of the delivery mechanism (including the spray arm **110**) and the control unit **106** may be externally mounted. The spray arm **110** may be configured to enter the process chamber **102** via a sealed pass-through or cut-out that is sufficient for the movement of the spray arm **110**. Alternatively, at least a portion of the delivery mechanism may be mounted inside the process chamber, one example of which is shown in **FIG. 2**.

[0039] **FIG. 2** shows a block diagram illustrating an exemplary system **200** for reducing backside particles in accordance with an embodiment of the present disclosure.

[0040] Compared with the system **100**, the system **200** similarly comprises a process chamber **202** that is coupled to a turbo pump **220** and a mechanical pump **222**. A platen **204** may be housed inside the process chamber **202**. The system **200** may also comprise a control unit **206** and a drive assembly **208** coupled to a nozzle **212**, which may be articulated, via a spray arm **210**. In contrast to the system **100** as shown in **FIG. 1**, the drive assembly **208** of the system **200** is mounted inside the process chamber **202**, in a corner of the process chamber **202** or another unobtrusive location. A source **214** of a cleaning substance may be coupled to the spray arm **210** via a feed-through or cut-out **216** in a wall of the process chamber **202**. Since the control unit **206** is externally mounted, the feed-through or cut-out **216** may also accommodate electrical control lines from the control unit **206** to the drive assembly **208**.

[0041] **FIG. 3** shows a flow chart illustrating an exemplary method for reducing backside particles from an electrostatic clamp in accordance with an embodiment of the present disclosure. The ESC platen may be inside a process chamber or a similar vacuum chamber. The exemplary method steps may be performed before a semiconductor processing job starts in the process chamber, after a job finishes, in between different jobs, or at any other time as desired. Also, these method steps may be repeated to reach a desired cleaning result.

[0042] In step **302**, the ESC platen, without any wafer thereon, may, for example, be secured in a "safe" position. It should be understood to those skilled in the art that the platen may be secured in other positions as well.

[0043] In step **304**, the process chamber may be vented to approximately atmospheric pressure.

[0044] In step **306**, a spray nozzle may be positioned above the ESC platen. The spray nozzle may be adjusted to provide a fine mist. Adjustment of the spray nozzle flow rate and spray density may typically depend on properties of a cleaning substance to be sprayed, as well as the expected interaction between the ESC platen surface and the cleaning substance.

[0045] In step **308**, the nozzle may spray a mist of DI water onto the ESC platen surface. While spraying, the nozzle may be moved in a sweeping motion across the ESC platen surface in order for the DI water droplets to cover the surface uniformly. Alternatively, the spray nozzle, which may or may not be articulated, may be in a fixed position, and the platen may move in a sweeping motion beneath the nozzle. Instead of DI water, a mixture of DI water and alcohol or other solvents may be sprayed. Alternatively, ionized dry air or ionized dry nitrogen may be used to spray the platen surface. In general, the nozzle may supply the cleaning substance to the ESC platen surface either at a gentle speed to coat the surface or at a relatively forceful speed to remove particles through momentum transfer. Further, the spraying of the cleaning substance does not have to fully cover the ESC platen surface. When desired or when necessary, a specified portion of the surface may be sprayed and cleaned through precision movement and/or orientation of the spray nozzle (and/or the platen).

[0046] According to one embodiment of the present disclosure, a snow of carbon dioxide (CO_2) may also be used as a cleaning substance. The CO_2 snow may comprise solid CO_2 particles that can effectively blast contaminant particles off the ESC platen surface or remove particles through other surface interactions. The CO_2 snow may be created from the conversion of liquid CO_2 to solid CO_2 and CO_2 gas. The liquid CO_2 may be delivered to the spray nozzle via a high purity pipeline. Within the spray nozzle, the CO_2 liquid may expand through an orifice and be transformed into a mixture of solid CO_2 particles and CO_2 gas. This mixture may then be directed at the ESC platen surface for cleaning purposes.

[0047] In step **310**, the process chamber may be pumped down to a desired vacuum level. Pumping gases from the process chamber helps remove residue of the cleaning substance to carry away contaminant particles from the ESC platen surface.

[0048] In step **314**, the ESC platen may be optionally gettered with a clean wafer to further reduce its particle count.

[0049] According to embodiments of the present disclosure, the above-described cleaning method may significantly reduce the presence of contaminant particles from an ESC platen. In one experiment, a 200 mm ESC with a composite surface coating had a particle count of approximately 24,933 prior to cleaning. After the 200 mm ESC was cleaned using a DI water mist spray as described above, the particle count was reduced to approximately 11,374, a reduction of over 50%. In another experiment, a 300 mm ESC was found to have a particle count of approximately 10,597 after being manually cleaned with a semiconductor wipe. However, after the same 300 mm ESC was cleaned with a DI water mist spray, only about 2,816 particles remained, which realized a particle reduction of ~70% compared with the conventional cleaning process.

[0050] Instead of spraying a platen from above, the cleaning substance may also be supplied to the platen surface through the platen itself. **FIG. 4** shows a block diagram illustrating an exemplary system **400** for reducing backside particles with this alternative approach.

[0051] The system **400** may comprise a process chamber **404** coupled to a turbo pump **420** and a mechanical pump **422**. A platen **404** may be housed inside the process chamber **402**. The platen **404** may have at least one feed-through channel **412** coupled with a matching pipeline **410**. The feed-through channel **412** and the pipeline **410** may be part of an existing coolant delivery system (not shown) for cooling the platen **404** and any wafer thereon. In the platen **404**'s top surface, there may also be one or more gas channels to accommodate coolant gases.

[0052] A control unit **406** may control a supply of a cleaning substance(s) from a source **414** of a cleaning substance(s), via pipelines **416** and **410** and through the feed-through channel **412**, to the surface of the platen **404**.

[0053] Once supplied through the feed-through channel **412**, it may be desirable to control the cleaning substance's flow and distribution across the surface of the platen **404**. Accordingly, a flat member **408** may be positioned proximately above the surface of the platen **404** prior to the flowing of the cleaning substance. The flat member **408** may have a bottom surface that is substantially flat or otherwise comparable to the surface of the platen **404**. According to one embodiment, the flat member **408** may be a semiconductor wafer or a similarly shaped object. The flat member **408** may be positioned at such as a small distance (e.g., 0.02-0.5 mm) from the platen **404** that a small gap **411** may be formed between the bottom surface of the flat member **408** and the surface of the platen **404**. The small gap **411** may help spread the cleaning substance across the surface of the platen **404** and thus improve surface interaction. Gas channels in the platen surface will facilitate an even distribution of the cleaning substance.

[0054] At the same time as or after the cleaning substance is supplied to the platen surface, the process chamber **402** may be pumped down to a desired vacuum level to facilitate the removal of the cleaning substance together with contaminant particles from the platen **404**.

[0055] As stated above, the delivery mechanism for the cleaning substance may take advantage of an existing coolant delivery system. **FIG. 5** shows a block diagram illustrating an exemplary system **500** for reducing backside particles in which an add-on subsystem **50** may be incorporated with an existing gas cooling and ballast system.

[0056] In the system **500**, a platen **502** may be mounted on a tilt/rotate assembly **506**. The gas cooling and ballast system may comprise a ballast tank **520**, a gas system **522**, a ballast valve **516**, an air bearing **512**, a pipeline **510**, a gas cooling valve **508**, and a feed-through channel **504**, which, together, serve to cool the semiconductor wafer.

[**0057**] The add-on subsystem **50** may comprise one or more sources of a cleaning substance(s) (e.g., Cleaning Substance **1**, Cleaning Substance **2**, and Cleaning Substance **3**). These cleaning substance sources may be coupled to a two-way valve **514** via on/off valves **518** and pipelines **517**. With the two-way valve **514**, the add-on subsystem **50** may take advantage of the existing setup for gas cooling. The add-on subsystem **50** may further comprise a control unit **515** that may be coupled to a control module (not shown) for the gas cooling system. The control unit **515** may regulate the valves **514** and **518** in the subsystem **50**, as well as values **508** and **516**, thereby controlling the flow of either cleaning substances or cooling gases to the platen **502**.

[**0058**] The present disclosure is not to be limited in scope by the specific embodiments described herein. Indeed, other various embodiments of and modifications to the present disclosure, in addition to those described herein, will be apparent to those of ordinary skill in the art from the foregoing description and accompanying drawings. Thus, such other embodiments and modifications are intended to fall within the scope of the present disclosure. Further, although the present disclosure has been described herein in the context of a particular implementation in a particular environment for a particular purpose, those of ordinary skill in the art will recognize that its usefulness is not limited thereto and that the present disclosure may be beneficially implemented in any number of environments for any number of purposes. Accordingly, the claims set forth below should be construed in view of the full breadth and spirit of the present disclosure as described herein.

1. An apparatus for reducing backside particles, the apparatus comprising:

a delivery mechanism configured to supply a cleaning substance to a platen, wherein the platen is housed in a process chamber; and

a control unit configured to:

cause the process chamber to reach a first pressure level,

cause the cleaning substance to be supplied to a surface of the platen, and

cause the process chamber to reach a second pressure level, thereby removing contaminant particles, together with the cleaning substance, from the surface of the platen.

2. The apparatus according to claim 1, wherein the establishment of the second pressure level in the process chamber causes at least a portion of the cleaning substance to sublimate, thereby removing the contaminant particles from the surface of the platen.

3. The apparatus according to claim 1, wherein the platen is an electrostatic clamp having a composite surface coating.

4. The apparatus according to claim 1 further comprising:

a wafer handling mechanism that transfers a clean wafer onto and then from the platen, thereby removing contaminant particles from the surface of the platen.

5. The apparatus according to claim 1, wherein:

the delivery mechanism comprises a nozzle and a drive assembly;

the drive assembly is configured to position the nozzle proximate to the surface of the platen; and

the control unit is configured to cause the nozzle to spray the surface of the platen with the cleaning substance.

6. The apparatus according to claim 5, wherein the nozzle is an articulated nozzle.

7. The apparatus according to claim 5, wherein the nozzle is positioned approximately six inches above the surface of the platen.

8. The apparatus according to claim 5, wherein the control unit is capable of causing the drive assembly to sweep the nozzle across the surface of the platen, thereby applying a substantially uniform coating of the cleaning substance to the surface.

9. The apparatus according to claim 5, wherein the control unit is capable of causing the drive assembly to move the platen in a sweeping motion relative to the nozzle, thereby applying a substantially uniform coating of the cleaning substance to the surface.

10. The apparatus according to claim 1, wherein:

the cleaning substance comprises deionized water; and

a mist of the deionized water is sprayed onto the surface of the platen to coat the surface with droplets of the deionized water.

11. The apparatus according to claim 1, wherein:

the cleaning substance comprises carbon dioxide; and

the surface of the platen is sprayed with a snow of the carbon dioxide, the snow comprising solid carbon dioxide particles.

12. The apparatus according to claim 1, wherein:

the cleaning substance comprises an ionized gas; and

the ionized gas is supplied to the surface of the platen to neutralize electrically charged particles.

13. The apparatus according to claim 1, wherein the delivery mechanism comprises a flat member that is positioned above the surface of the platen at such a small distance that the space between the flat member and the surface of the platen causes the cleaning substance to be spread across the surface.

14. The apparatus according to claim 10, wherein the flat member is positioned approximately 0.02-0.5 mm above the surface of the platen.

15. The apparatus according to claim 10, wherein the flat member is of a shape similar to a semiconductor wafer.

16. The apparatus according to claim 10, wherein the flat member is a semiconductor wafer and the backside of the semiconductor wafer is cleaned together with the surface of the platen.

17. The apparatus according to claim 10, wherein at least a portion of the delivery mechanism is also capable of supplying the platen with a coolant.

18. The apparatus according to claim 1, wherein the cleaning substance comprises one or more substances selected from a list consisting of:

DI water,

alcohol,

carbon dioxide,

ionized dry air, and

ionized dry nitrogen.

19. The apparatus according to claim 1, wherein the second pressure level is substantially lower than the first pressure level.

20. The apparatus according to claim 1, wherein at least a portion of the apparatus is installed inside the process chamber.

21. The apparatus according to claim 1, wherein at least a portion of the apparatus is installed outside the process chamber.

22. A method for reducing backside particles, the method comprising the steps of:

positioning a platen inside a process chamber;

venting the process chamber to a first pressure level;

supplying a cleaning substance to a surface of the platen; and

pumping the process chamber to a second pressure level, thereby removing contaminant particles, together with the cleaning substance, from the surface of the platen.

23. The method according to claim 22, wherein the pumping of the process chamber causes at least a portion of the cleaning substance to sublimate, thereby removing the contaminant particles from the surface of the platen.

24. The method according to claim 22, wherein the platen is an electrostatic clamp having a composite surface coating.

25. The method according to claim 22 further comprising:

transferring a clean wafer onto and then from the platen, thereby removing contaminant particles from the surface of the platen.

26. The method according to claim 22 further comprising:

spraying the cleaning substance onto the surface of the platen in a sweeping pattern, thereby applying a substantially uniform coating of the cleaning substance on the surface.

27. The method according to claim 22, wherein:

the cleaning substance comprises deionized water; and

a mist of the deionized water is sprayed onto the surface of the platen to coat the surface with droplets of the deionized water.

28. The method according to claim 22, wherein:

the cleaning substance comprises carbon dioxide; and

the surface of the platen is sprayed with a snow of the carbon dioxide, the snow comprising solid carbon dioxide particles.

29. The method according to claim 19, wherein:

the cleaning substance comprises an ionized gas; and

the surface of the platen is sprayed with the ionized gas.

30. The method according to claim 22 further comprising:

positioning a flat member above the surface of the platen at such a small distance that the space between the flat member and the surface of the platen causes the cleaning substance to be spread across the surface.

31. The method according to claim 30, wherein the flat member is positioned approximately 0.02-0.5 mm above the surface of the platen.

32. The method according to claim 30, wherein the flat member is of a shape similar to a semiconductor wafer.

33. The method according to claim 30, wherein the flat member is a semiconductor wafer and the backside of the semiconductor wafer is cleaned together with the surface of the platen.

34. The method according to claim 22, wherein the cleaning substance comprises one or more substances selected from a list consisting of:

DI water,

alcohol,

carbon dioxide,

ionized dry air, and

ionized dry nitrogen.

35. The method according to claim 22, wherein the second pressure level is substantially lower than the first pressure level.

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